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FLOW NOZZLES

For many years flow nozzles have been used in commercial measurements of fluid flows, and in conjunction with various experiments and machine tests. Usually the nozzles either have been calibrated, or the factors to be used in computing the rate of flow have been assumed on the basis of previous tests of similar nozzles. The published information on the characteristics of these nozzles is limited and scattered. Of the majority of nozzles used in the United States the one common design feature has been that their total lengths (measured along the axis of flow) ranged from one and a quarter to two times their throat diameters.

The development of power test codes has made it necessary to specify rather definitely the design, method of use, and proper numerical factor for flow nozzles when these are employed in connection with acceptance tests involving fluid measurements. The data on nozzles, as mentioned above, were not sufficient to form a basis for such test codes. There was available, however, a suggested code on the design and use of flow nozzles, prepared by a committee of the International Standards Association (ISA) on the basis of extensive tests made in Europe. These nozzles were much shorter than those which had commonly been used in the United States, and the method of mounting them in a pipe line was distinctly different. It was found that a majority of the makers and users of flow nozzles in this country were opposed to the full adoption of the suggested ISA design and practice, at least until the possibilities of using the longer nozzle ("long-radius" nozzle) had been thoroughly studied.

This situation led the Main Power Test Code Committee of the American Society of Mechanical Engineers to request the Special Research Committee on Fluid Meters to carry out a research program on flow-nozzles, particularly of the long-radius type. The Fluid Meters Committee decided to comply with the request. For the more efficient handling of the program the

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following subcommittee was appointed to have its full direction: H. S. Bean, Chairman; S. R. Beitler; J. R. Carlton; R. E. Sprenkle; E. C. M. Stahl; and R. J. S. Pigott, ex-officio.

This subcommittee has adopted a basis for designing the long-radius nozzles to be used, which is a combination of two designs previously employed. About 30 nozzles have been constructed, and more will be made. The throat diameters of these nozzles range from ¼ inch to 13 inches. It was soon recognized that, owing to the difficulties of maching a nozzle exactly to any mathematically specified shape, and in view of the fact that the nozzles were to be made by different manufacturers, there should be some check on their contours. Such measurements give a basis for comparison of fabrication processes and are of importance in correlating and interpreting the data obtained by the testing laboratories.

Measurements of the nozzles have, therefore, been made at the Bureau. An apparatus has been constructed consisting of a surface plate with an upright plug of adjustable height. The nozzle is placed over this plug on its upstream flange surface, and moved from side to side diametrically. By observing the horizontal displacement and adding the known diameter of the plug the diameter of the nozzle is determined at any section desired.

As it is impossible to test all of the nozzles over the desired range of conditions at any one laboratory, arrangements have been made to have tests conducted in the engineering laboratories of seven universities as well as at the Bureau. At present tests are in progress at the Bureau and at three universities. Doubtless some additional tests will be made at industrial plants. Already test data have been gathered on five nozzles from four laboratories. These have been found to be in very close agreement.

STRENGTH OF WELDED JOINTS IN AIRCRAFT PARTS

Welding plays an important part in the construction of the modern airplane because it is an efficient method of joining steel sheet and tubular members. Accurate information is necessary on the strength of welds in chromium-molybdenum steel (the alloy generally used) in order that aircraft may be safely and efficiently designed. Continuing an investigation of which one report has already been published (NACA Technical Report 348) further tests have been made on typical welded joints in chromium-molybdenum steel tubing and sheet. The results have just been made available as NACA Technical Report 584, obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy.

Tests were made on three kinds of oxy-acetylene welds consisting of: (1) welds made by the usual process in which low-carbon steel welding rod and a neutral flame were used; (2) similar welds made with chromium-molybdenum steel welding rod; and (3) the recently developed "carburizing flux" process in which a special technique with an excess acetylene flame was used. In welding joints in tubing having a very thin wall (1½ in. outside diameter by 0.020-in. wall) only the carburizing flux process was found to produce joints which were free from cracks. These were detected by means of the "magnetic dust" method of inspection. Butt joints in heavier chromium-molybdenum tubing and sheet made by the three kinds of welds had about equal strengths in the "as welded" condition. When heat-treated the joints made by the carburizing flux process and those welded with chromium-molybdenum rod were stronger than joints in which low-carbon welding rod was used.

The strength of tubular joints loaded under tensile, compressive, and bending stresses has been determined, both "as welded" and in the heat-treated condition. In some kinds of joints it was found that gusset plates inserted in slots in the tubing materially increased the strength.

WAVE LENGTHS IN THE ULTRAVIOLET SPECTRUM OF IRON

Wave lengths corresponding to monochromatic spectral radiations are easily measured with high precision if suitable standards are available. To facilitate such measurements in spectroscopy and astrophysics, the International Astronomical Union has compiled and adopted a system of standards consisting of a primary (the red radiation from cadmium measured relative to the meter), and numerous secondary standards distributed throughout the spectrum of iron. The latter are determined relative to the former but they achieve international recognition only after three concordant but independently determined values are available. In 1928 the IAU adopted 244 values of visible and near ultraviolet iron lines as secondary standards, and recommended that measurements be made of longer and shorter waves. Since then,

two series of determinations of shorter waves (one made at the Imperial College, London, and the other at Allegheny Observatory, Pittsburgh) have been published. Drs. William F. Meggers and Curtis J. Humphreys of the Bureau now supply a third set of values, which will make it possible to extend the international secondary standards about two-thirds of an octave to shorter waves, thus covering the range most commonly used in spectroscopic observations. These standards, which are reported in RP992 (Journal of Research for May), are determined from measurements of interference patterns produced under specified conditions by the individual lines, and the final values are believed to be correct within 1 part in 2 or 7 millions. The values now being published by the Bureau are given, in many cases, to eight significant figures since calculations of probable errors and tests of relative value by means of the combination principle (constancy of wave number differences of pairs of lines having two atomic energy states in common) indicate errors of the order of 1 part in 10 millions.

PREPARATION OF IRON OXIDE AS A SOURCE OF HIGH-PURITY IRON

Iron is the most important metal in our modern civilization, but it has never been prepared in an absolutely pure state, i. e., completely free from all impurities, or even in as high a state of purity as has been attained for some other metals—gold, platinum, zinc, and aluminum, for example. Consequently, the fundamental properties of iron, on which the properties of commercial irons and steels are based, have never been directly determined. The best available information about many of the properties of pure iron has been obtained by indirect methods from samples of unknown purity; the accuracy of such data is unknown.

One of the current research projects at the Bureau is an attempt to prepare metallic iron of high purity and definitely known composition, in order that the properties of this material may be determined. As a preliminary step in the preparation of metallic iron, H. E. Cleaves and J. G. Thompson have prepared purified iron oxide which is free from even spectroscopic traces of 46 elements, and in which silicon is the only impurity present in amounts in excess of 0.001 percent. Other elements present are aluminum, calcium, magnesium, and copper but the sum of these four impurities is less than 0.001 percent. Attempts will be made to convert this oxide to metallic iron without introducing further contamination.

For a more complete report of this work, RP996 in the May number of the Journal of Research should be consulted.

RAPID ELECTRODEPOSITION OF IRON FROM FERROUS CHLORIDE BATHS

Many of the plates used at the Bureau of Engraving and Printing for printing currency and securities are made by electrodeposition of nickel and iron, and are finally coated with a thin, very hard layer of chromium. In studying the methods used in making these plates, Charles Kasper of the electrochemistry section of the National Bureau of Standards has found that by careful control of the temperature and acidity of the iron chloride bath, it is possible to deposit the iron (which makes up most of the printing plate) at the rate of about twelve thousandths of an inch per hour. This is about five times the usual rate. The favorable conditions are most critical, and hence the rapid process is chiefly useful for special occasions, for example, when new designs of plates are first made. A more detailed account of this discovery will be found in the May number of the Journal of Research (RP991).

MEASURING THE THICKNESS OF NICKEL COATINGS

In general, the protective value of nickel coatings on either steel or brass, including those covered with the usual thin chromium layer, depends largely upon the thickness of the nickel. This has usually been specified in terms of the average thickness, but now a certain minimum thickness is often required.

Rapid methods of measuring the thickness at any point are therefore desirable. Most of the methods now used destroy the coating or the article. In RP994, which will be published in the May number of the Journal of Research, A. Brenner describes a nondestructive method for measuring the thickness of nickel coatings on metals such as brass and zinc.

A small spring balance is used to measure the force of attraction between the nickel coating and a small permanent magnet. The thickness of the nickel is indicated by the reading of the dial, which is standardized against a similar nickel coating of known thickness. Before testing nickel coat-

ings of unknown source, they should be annealed for a short time at 400° C. (750° F).

It is believed that this method will prove useful for factory control of the plating on such articles as brass hardware and plumbing fixtures.

A CONTRIBUTION TO THE CHEMISTRY OF RHENIUM

Rhenium, the discovery of which was announced in 1925, is the last member of the family of the elements which has been isolated and is available in suffcient amount to permit general investigations of its properties. Many of its chemical reactions are still matters of considerable uncertainty, in spite of the numerous articles which have appeared in the past few years.

G. E. F. Lundell and H. B. Knowles of the Bureau's Chemistry Division recently studied the behavior of rhenium when dilute solutions of potassium perrhenate are acidified with sulphuric acid, cooled, and passed through a column of amalgamated zinc. This indicates that rhenium forms a compound in which it has a valency of minus one, and that the rhenium in this compound is oxidized to a valency of plus one if the diluted sulphuric acid solution is protected from oxygen and warmed to approximately 50° C.

In the course of the investigation, which will be reported in full in the May number of the Journal of Research (RP999), it was also found (1) that rhenium can be electrodeposited from diluted (5+95) sulphuric acid solution; (2) that deposits are slightly contaminated; and (3) that the deposited metal can be oxidized directly to perrhenic acid by exposure to moist air, oxygen, or by making the deposit the anode in a water solution.

DETERMINATION OF THE EDGE CORRECTION IN MEASUREMENTS OF DIELECTRIC CONSTANT

It is not always possible or practical to use the guard ring system of electrodes in the determination of the dielectric constants of sheet insulating materials. Other methods have been used and still others have been proposed. The purpose of an investigation by Arnold H. Scott of the Bureau's inductance and capacitance section was to check the accuracy of methods using circular electrodes.

The guard ring method produces a uniform field between the measuring electrodes and is, therefore, accurate and simple. When, however, a guard electrode is not used a correction to the usual simple equation for computing dielectric constant must be applied because of the fringing of the field at the edges of the electrodes. The amount of the correction depends on the arrangement of the electrodes. Theoretical equations have been derived for determining these corrections for certain arrangements. Measurements have been made on specimens of glass, hard rubber, and marble with these same arrangements of electrodes. Assuming the guard ring values to be correct, the accuracy of the other methods was determined.

Two of the methods yielded results which agreed with the guard ring values within less than 1 percent. Three of the other methods yielded values which were in error by less than 2 percent. The values obtained by the other methods were in error by 2½ to 7 percent. Since many of the dielectric materials are not reproducible within 2 percent, five of the methods should give satisfactory results.

STATE OF THE SULFUR IN OXIDIZED WOOL

In RP998, which will be published in the May number of the Journal of Research, Milton Harris and Arthur L. Smith report on recent investigations relating to the oxidation of wool. These indicate that the stability of the fiber is closely related to the state of the sulfur in the wool protein. The bulk of the sulfur in untreated wool is present as cystine sulfur and the maximum stability of the fiber is obtained when the sulfur is in this form. Changes in the state of this sulfur, such as produced by oxidizing and reducing agents or by light, may result in the direct degradation of the fiber, or in incipient damage, which may be greatly aggravated in the subsequent processing of the fiber. Therefore the proportion of the total sulfur in wool which exists in the disulfide form is very significant.

During treatment with oxidizing agents, the disulfide sulfur in wool appears to be changed to higher states of oxidation. The existence of oxidation derivatives of the disulfide compounds is indicated by the alkali-solubility determination, the lead acetate test, by reduction with hydrochloric acid-potassium iodide solutions, and by cystine analyses.

The intermediate oxidation derivatives of cystine are unstable under the conditions necessary for protein hydrolysis, and at least one of them, cystine disulfoxide, is partially converted to cystine. The results indicate that the values obtained for the cystine con-

tent of oxidized wool may be expected to be higher than the actual cystine content since they represent the amount of cystine formed from the partially oxidized cystine compounds as well as from unoxidized cystine groups.

EFFECT OF SIZING, WEAVING, AND ABRASION ON THE PHYSICAL PROPERTIES OF COTTON YARN

An investigation is being conducted by the Bureau in cooperation with the Alabama Polytechnic Institute, on the effect of weaving and abrasion on the physical properties possessed by cotton yarn before and after it is sized with white potato starch. Breaking strength, elongation at rupture, elongation under a load of 35 g, and permanent set after this load was removed. were measured on unsized yarns and on yarns sized with varying amounts of white potato starch. The sized yarns had higher strength, lower elongation at rupture and at a load of 35 g, and a lower permanent set after removal of the load than the unsized yarn.

The effect of weaving on these properties and on the increase in length was determined for both sized and unsized yarn. A machine was constructed for simulating the abrading and pulling action of the loom, and data were obtained on the physical properties of sized and unsized yarns which had been exposed for varying periods to the action of this machine. Weaving or abrading in this machine caused a slight decrease in strength, and had little effect on elongation or permanent set on both sized and unsized yarn. Either operation caused a small increase in length of unsized but not of sized yarn.

The results of this work are reported in RP993 by Walter T. Schreiber, M. N. V. Geib, and O. C. Moore, which will be published in the May number of the Journal of Research. Methods are suggested for establishing control tests in the mill to determine whether the yarn has been properly sized.

GLASS CONTENT OF PORTLAND CEMENT CLINKER

At the clinkering temperatures attained by present day methods of portland cement manufacture, a considerable part of the charge is present as a liquid phase. When the clinker is cooled rapidly, from the clinker temperature, part of the liquid phase will be present as an "undercooled liquid" or glass. RP997 by William Lerch and Lorrin T. Brownmiller which will be published in the May number of the Journal of Research, describes a method of approximating the glass content of portland cement clinker. The method is dependent on the heat changes involved in passing from a noncrystalline state (glass) to a crystalline state.

CALCULATION OF WHITEWARE HEAT-TREATMENTS

Starting with Arrhenius' equation expressing the relation between reaction rate and absolute temperature, mathematical formulas have been derived for the calculation of whiteware heat-treatments. Bodies containing "white-burning" clays, feldspar, and flint as the only ingredients are so uniformly pure that the rate of reactions taking place in them at elevated temperatures should lend itself to mathematical treatment, as do ordinary chemical reactions. The vitrification process was assumed to be a chemical reaction and Arrhenius' equation was applied. Using data from previous work, constants were calculated and expressions derived for the amount of reaction taking place during heat-treatment of a body. With the formulas obtained, any combination of heating rate and soaking period can be transposed to another combination of heating rate and soaking period having the same total reaction effect. The various amounts of reaction necessary to mature whiteware bodies of various RO contents have been calculated. At present, a given body is being heated according to various schedules to give the same calculated amount of reaction, and certain physical properties of the specimens are being determined for the purpose of correlation. Thus far the correlation between calculated heat treatment and physical properties seems very promising.

SPECIFIC REFRACTIVITY OF SOME GLASS-MAKING OXIDES

Since the previous statement on this subject, which was published in Technical News Bulletin 217 (May 1935) additional data have been assembled and further attempts have been made to correlate the refractivities and densities of glasses with their compositions.

The specific refractivities (R) of the ordinary glass-forming oxides, calculated from data on vitreous and crystalline materials, were considered in connection with both the hydrogen equivalent weights (W) of the oxides and the ionic radius (r) of the metallic ion in the oxide. It was found that the two-thirds power of the product of the

specific refractivity and hydrogen equivalent of the oxides plotted against the square of the radius of the metallic ion in the oxide gave two straight lines. One of these lines includes the oxides of Li, Na, K, Rb, Cs, Mg, Be, Ca, Sr. Ba, Al, Ce, B, Si, and the rare earth metals; the other line includes the oxides of all the other elements considered. The intercept of both the lines is 1.888 and the coefficient of the "r square" term is 1.554 in the first case and 3.108 in the second.

In this work the specific refractivities of 60 oxides were computed from more than 400 compounds reported in the International Critical Tables and the "R" values obtained in this way were found to be substantially the same as the corresponding "R" values obtained from data on glasses. In general, however, data from crystalline compounds were not used if the birefringence was greater than 0.02. The radii used were Pauling's theoretical radii for the most of the ions, but Goldschmidt's "observed radii" were used if Pauling's were not available.

SIMPLIFIED PRACTICE RECOMMENDATION FOR STEEL HEATING BOILERS

The simplification and standardization committee of the Steel Heating Boiler Institute drafted a proposed recommendation for steel horizontal firebox heating boilers, based on a variety survey conducted by the Bureau's Division of Simplified Practice. The schedule was approved on June 4, 1934 by a general conference of boiler manufacturers, users, and others interested, and later was modified in accordance with suggestions received during circularization of all interests for acceptance.

As finally accepted for promulgation, the recommendation, designated as Simplified Practice Recommendation R157–37, Steel Horizontal Firebox Heating Boilers, gives in the first table, 19 sizes of boilers for hand firing, ranging from 1,800 to 35,000 square feet of steam radiation, and from 2,880 to 56,000 square feet of water radiation; also 19 ratings of boilers for mechanical firing, ranging from 2,190 to 42,500 square feet of steam radiation, and from 3,500 to 68,000 square feet of water radiation. Table 1 also includes Btu per hour, heating surface, grate area, and furnace volume. Table 2 shows size of outlets and number and size of safety valves for each size of boiler. An appendix, consisting essentially of explanatory material as set forth in the Steel Heating Boiler Institute Rating Code, is also included.

The following statement by R. A. Locke, manager of the Steel Heating Boiler Institute, will indicate the potential benefits to the industry from the application of simplification to its product:

> In establishing standard sizes of boilers it is now possible for the manufacturers in our industry to make up stock during the slack season with reasonable assurance that this stock can be disposed of during the busy season. Prior to the establishment of these standard sizes of boilers there was such a large number of sizes of boilers manufactured by various members of the industry that it was impossible for any manufacturer to make up any appreciable stock, as a large percentage of the business was "custom made". More work along this line in many other industries will undoubtedly tend to give employment during the slack seasons.

The printed edition of the recommendation will contain, in addition to the standard boiler ratings and pipe connection openings, a brief history of the project, the personnel of the standing committee, and a list of organizations and firms that have accepted the program.

Until the printed book is available, free mimeographed copies may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C. The recommendation became effective January 1, 1937.

AMERICAN STANDARD SPECIFICATION FOR DRY CELLS AND BATTERIES

The publication of a revision of the American Standard for dry cells in Circular C414 of the National Bureau of Standards calls for a brief history of the project.

A committee of the American Electrochemical Society recommended standard methods for testing dry cells in 1912. Although much has been accomplished in developing specifications for dry cells since that time, the influence of these early recommendations on some of the tests now in use is still discernible.

The preparation of nationally recognized specifications to include sizes of cells, arrangement of the cells in batteries, tests, and required performance, began in 1917 with the drafting of specifications which were later approved by representatives of manufacturers, the War Industries Board, and several Governmental departments. These specifications were published in the Bureau of Standards' Circular C79, on Dry Cells. A revision was made in 1921 and this was later approved as standard specification of the Government.

In 1924 the need for a more permanent and representative committee to deal with recurring revisions of the specifications became apparent, with the

result that the American Engineering Standards Committee (now the American Standards Association) authorized the formation of a sectional committee on dry cells under the sponsorship of the National Bureau of Standards. This committee of 22 members, including representatives of manufacturers, the largest commercial consumers, the Government, and several independent associations, has been active since its organization in 1926 in preparing three revisions of the specifications whch became American Standards in 1928, 1930, and 1937.

Close cooperation has been maintained between this committee and another committee charged with responsibility for preparing Federal Specifications on the same subject. Federal Specifications issued in 1931 and 1935 have been concordant with the American Standard Specifications although differing in form.

Periodic revisions of the American Standard Specification for dry cells become necessary as a result of changes in the art. New types and uses for batteries require new tests. Notable improvements in the capacity and performance of dry cells within recent years justify increased requirements. The new specification of 1937 reflects the advances made in the better grades of cells. In general, the capacity of the better dry cells and batteries has been increased three to fourfold since the specifications of 1917 were prepared. The result has been considerable gain to the public at large.

Copies of the new Circular are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D .C., at 5 cents each.

NEW AND REVISED PUBLICATIONS ISSUED DURING APRIL 1937

Journal of Research [1]

Journal of Research of the National Bureau of Standards, volume 18, number 4, April 1937 (RP983 to RP989, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers [1]

[Reprints from the January, February, and March, 1937 Journal of Research]

RP957. Redetermination of the atomic weight of aluminum. James I. Hoffman and G. E. F. Lundell. Price 5 cents.

RP958. Methods of determining gloss. Richard S. Hunter. Price 5 cents.

RP959. A microburette for testing the absorptiveness of thin paper. F. T. Carson. Price 5 cents.

RP960. Thermal expansion of cemented tungsten carbide. Peter Hidnert. Price 5 cents.

RP961. Deterioration of chromic acid baths used for anodic oxidation of aluminum alloys. R. W. Buzzard and J. H. Wilson. Price 5 cents.

RP965. Pressure losses for fluid flow in curve pipes. Garbis H. Keulegan and K. Hilding Beij. Price 10 cents.

RP966. Heats of combustion of the liquid normal paraffin hydrocarbons from hexane to dodecane. Ralph S. Jessup. Price 5 cents.

RP967. Separation of constant-boiling mixtures of naphthene and paraffin hydrocarbons by distillation with acetic acid. Sylvester T. Schicktanz. Price 5 cents.

RP968. Determination of sulphur occurring as sulphide in portland cement. Harry A. Bright. Price 5 cents.

RP969. Bromine oxidation and mutarotation measurements of the alpha- and beta-aldoses. Horace S. Isbell and William W. Pigman. Price 10 cents.

RP970. Effect of temperature on the stress-deformation of concrete. Arthur U. Theuer. Price 5 cents.

RP971. Accurate representation of the refractivity and density of distilled water as a function of temperature. Leroy W. Tilton and John K. Taylor. Price 5 cents.

RP972. Compressive strength of structural tile masonry. Douglas E. Parsons and David Watstein. Price 10 cents.

RP973. Simplified determination of resin in papers and pulps. Herbert F. Launer. Price 5 cents.

RP974. Permeability to moisture of synthetic resin finishes for aircraft. Gordon M. Kline. Price 5 cents.

RP975. Anodizing of aluminum alloys of chromic acid solutions of different concentrations. Robert W. Buzzard. Price 5 cents.

RP976. Cooperative study of methods for the determination of oxygen in steel. John G. Thompson, Herbert C. Vacher, and Harry A. Bright. Price 10 cents.

RP977. A new phenomenon in the superconducting transition of tantalum and of tin. Francis B. Silsbee, Russell B. Scott, and Ferdinand G. Brickwedde. Price 5 cents.

RP978. Optical rotation and atomic dimension for the four optically active 1-halogeno-2-methylbutanes. Dirk H. Brauns. Price 5 cents.

RP979. Simplified volumetric determination of alpha, beta, and gamma cellulose in pulps and papers. Herbert F. Launer. Price 5 cents.

See footnote on p. 56.

RP980. Reaction of wool with strong solutions of sulfuric acid. Milton Harris, Ralph Mease, and Henry Rutherford. Price 5 cents.

RP981. Performance characteristics of a water current meter in water and in air. Galen B. Schubauer and Martin A. Mason. Price 5 cents.

RP982. Soil-corrosion studies, 1934. Field tests of nonbituminous coatings for underground use. Kirk H. Logan and Scott P. Ewing. Price 10 cents.

Circulars [1]

C414. American standard specification for dry cells and batteries. (Supersedes C390.) Price 5 cents.

Technical News Bulletin [1]

Technical News Bulletin 240, April 1937. Price 5 cents. Obtainable by subscription.

MIMEOGRAPHED MATERIAL

Letter Circulars

Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or to send copies automatically as issued.

LC491. Electrical interference with radio reception. (Replaces LC415.)

LC492. Weights and measures publications of general interest. (Replaces LC399.)

Technical Information on Building Materials

The supply of these notes, each of which consists of three or four pages giving the important facts on some one aspect of the properties or use of building materials, is necessarily limited. Their distribution will be confined to Government officials concerned with building projects, and to architects, engineers, and home builders. Requests should make clear the actual need for the information at the time of writing. Letters should be addressed to the Division of Codes and Specifications, National Bureau of Standards, Washington, D. C. The following note was issued since the list published in the April 1937 number of the Technical News Bulletin:

TIBM–46. Volatile thinners.

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [2]

Thermal expansion of cemented tungsten carbide. Peter Hidnert. Science Abstracts [A] (Institution of Electrical Engineers, London, England) **40**, 175 (February 1937).

The interpretation and uses of lens tests and camera calibrations. Irvine C. Gardner. Photogrammetric Eng. (Am. Soc. Photogrammetry, Washington, D. C.) **3**, no. 1, 12 (January, February, March, 1937).

Strength of welded aircraft joints. W. C. Brueggeman. Nat. Advisory Com. Aeronautics (Washington, D. C.) Report 584 (April 1937). (Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy.)

Mechanism of the sulfur lability in the alkali degradation of wool protein. J. A. Crowder and Milton Harris. Rayon Textile Monthly (303 Fifth Avenue, New York, N. Y.) **18**, 159 (March 1937).

Test methods for women's washable cotton and rayon gloves. Richard S. Cleveland. Rayon Textile Monthly **18**, 173 (March 1937).

Calibration of a "constant rate of loading" machine for testing the tensile properties of textiles. Richard S. Cleveland. Rayon Textile Monthly **18**, 179 (March 1937).

The chemical processing of wool. Milton Harris and A. L. Smith. Chem. Industries (25 Spruce Street, New York, N. Y.) **40**, 269 (March 1937).

Air treatment for preservation of records in libraries. B. W. Schribner. Refrigerating Eng. (37 West Thirty-ninth Street, New York, N. Y.) **33**, 233 (April 1937).

Atmospheric corrosion testing. H. S. Rawdon. Preprint (mimeographed), regional meeting, Am. Soc. Testing Materials (260 South Broad Street, Philadelphia, Pa.) (March 1937).

Factors affecting plastic deformation of sheet and strip steel and their relation to the deep-drawing properties. Discussion of paper by Winlock and Lester. H. S. Rawdon. Trans. Am. Soc. Metals (7016 Euclid Avenue, Cleveland, Ohio) **25**, 187 (March 1937).

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research $2.50 per year (United States and its possessions, and Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

[2] These publications are not obtainable from the Government unless otherwise stated. Requests should be sent direct to the publishers.

U. S. GOVERNMENT PRINTING OFFICE: 1937